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# Bridging Heritage Management and Architectural Education in Tanzania: Insights from the Reconstruction of the House of Wonders, Zanzibar

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## ABSTRACT

Effective conservation of built cultural heritage in Tanzania requires specialized architectural competencies insufficiently addressed in current professional training and architectural education. This study uses the reconstruction of the House of Wonders in Stone Town, Zanzibar, a UNESCO World Heritage Site, to examine the competency demands of heritage conservation practice. Rather than presenting a comprehensive national curriculum evaluation, the study uses the reconstruction of the House of Wonders as a context-specific case that makes broader educational and professional challenges visible. The research adopted a qualitative case study approach based on semi-structured interviews with six key stakeholders involved, including an architect, structural and safety engineers, a quantity surveyor, a historian, and an artisan. Thematic analysis revealed significant gaps between conventional architectural curricula and the realities of conservation practice. Findings indicate that architects must assume expanded roles beyond design, including documentation, materials conservation, regulatory compliance, interdisciplinary coordination, and community engagement, which are often underemphasized in Tanzanian training. Systemic constraints were also identified, including financial limitations, regulatory inconsistencies, scarcity of traditional materials, reliance on external expertise, and weak institutionalized knowledge transfer. The study recommends strengthening heritage-oriented architectural education and professional training by integrating conservation competencies, digital technologies, and structured capacity-building mechanisms.

**Keywords**: Swahili heritage; Conservation governance; Heritage competencies; Interdisciplinary conservation; Stone Town; Built cultural heritage

## INTRODUCTION

Bridging architectural education and heritage management is increasingly important for safeguarding historic buildings amid rapid urbanization and socio-economic transformation. In Tanzania, sustainable conservation depends not only on institutional and financial support but also on a technically competent workforce equipped with heritage-specific skills. In Stone Town, Zanzibar, a UNESCO World Heritage Site, the reconstruction of the House of Wonders (Beit al-Ajaib) has exposed persistent tensions between architectural education and the practical realities of conservation practice (A.R.S. Progetti S.p.A., 2020; A.R.S. Progetti S.p.A. et al., 2020; ICOMOS, 2013; Yahya & Associates,

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2008). Built between 1880 and 1883 under Sultan Barghash bin Said, the building remains a defining cultural and architectural symbol shaped by Swahili, Islamic, and European influences. Repeated structural failures, including the catastrophic collapse in December 2020, exposed both material vulnerabilities and systemic weaknesses in conservation planning, professional training, and implementation (UNESCO World Heritage Centre, 2021). These events intensified scrutiny of architectural education in Tanzania, where heritage-specific content often remains limited or fragmented within predominantly modernist training structures. UNESCO and ICOMOS reports from 2013 to 2023 document recurring concerns, including inadequate technical oversight, weak institutional coordination, and shortages of trained conservation professionals (ICOMOS, 2013; UNESCO et al., 2016, 2019, 2023).

Architectural curricula across East Africa often prioritize Eurocentric design principles and studio-based pedagogies, leaving limited space for heritage and vernacular knowledge (Olweny, 2020, 2023). At Ardhi University, the country's oldest architecture school, heritage conservation is generally offered as an elective with limited emphasis on experiential learning or interdisciplinary integration (Mosha, 2016). Recent research further identifies documentation, material conservation, stakeholder engagement, and cultural sensitivity as essential competencies that remain underrepresented in many architectural programs (Vedasto et al., 2025). In this study, the "gap" refers not to the complete absence of heritage-related content, but to the mismatch between fragmented training exposure and the practical demands of conservation practice. These gaps contrast with international conservation frameworks, including the Burra Charter and ICOMOS education guidelines, which emphasize documentation, ethics, interdisciplinary collaboration, and cultural sensitivity as foundational competencies (Australia ICOMOS, 2013; ICOMOS, 1993). Consequently, many graduates enter practice insufficiently prepared to navigate the cultural, material, and regulatory complexities of heritage sites such as Stone Town.

Despite growing conservation challenges in Tanzania, limited empirical research has examined alignment of architectural education with the competencies demanded by major conservation projects. Existing studies identify weaknesses in conservation capacity and heritage training in East Africa, yet few examine how these gaps become operationally visible during large-scale reconstruction projects. The reconstruction of the House of Wonders, therefore, provides an opportunity to examine tensions between professional training, institutional capacity, and conservation practice. This study therefore aims to: (1) identify the competencies required in heritage conservation practice during the reconstruction of the House of Wonders; (2) examine how current architectural training aligns with these competency demands; (3) analyze institutional and operational constraints affecting conservation practice; and (4) propose directions for strengthening heritage-oriented architectural education and professional training in Tanzania. This article examines the reconstruction of the House of Wonders as a lens for analyzing the disconnect between heritage management demands and architectural education in Tanzania. It seeks to identify the competencies required for sustainable conservation that remain underdeveloped or absent in current curricula. Specifically, the study asks: What competencies are lacking in Tanzanian architectural education that limit effective participation in heritage conservation projects such as the reconstruction of the House of Wonders? Rather than presenting a comprehensive national evaluation of architectural

curricula, the article uses the reconstruction of the House of Wonders as an instrumental case study through which broader educational, institutional, and professional challenges become visible. By examining one of East Africa's most significant heritage landmarks, the study contributes to debates on architectural education and heritage management by highlighting institutional, technical, and educational gaps while proposing directions for heritage-oriented curricula, education reform in Tanzania, and related East African contexts.

## BRIEF LITERATURE REVIEW

Architectural heritage embodies the historical, cultural, technological, and social identity of societies, serving as a tangible record of human civilization and collective memory. Beyond their cultural significance, heritage buildings contribute to education, tourism, urban identity, and sustainable development. Their conservation therefore requires specialized knowledge that extends beyond conventional architectural design and construction practice to include heritage documentation, material conservation, regulatory compliance, risk management, and multidisciplinary project coordination. Globally, heritage conservation practice has increasingly evolved into a technically specialized and interdisciplinary field requiring competencies in architecture, engineering, history, archaeology, conservation science, and digital documentation technologies (Feilden & Jokilehto, 1998; ICOMOS, 1993; UNESCO, 2011; UNESCO World Heritage Centre, 2024). Contemporary conservation projects frequently involve complex technical decision-making concerning structural stabilization, historical authenticity, adaptive intervention, material compatibility, and long-term preservation management. Despite this growing complexity, architectural education in many developing contexts continues to prioritize mainstream design, construction technology, and urban development, with comparatively limited emphasis on heritage conservation competencies. This creates a disconnect between academic preparation and the practical demands of conservation projects, particularly where historic structures require specialized intervention.

In Tanzania, the challenge is especially relevant given the country's rich built heritage, which includes historic coastal settlements, colonial-era civic buildings, Swahili architectural heritage, religious structures, and culturally significant urban landmarks. Notable heritage assets such as those in Zanzibar, Bagamoyo, Kilwa, and other historic settlements require technically competent professionals capable of balancing conservation principles with structural rehabilitation, regulatory compliance, and modern engineering requirements. One of the most prominent examples is the House of Wonders (Beit-al-Ajaib) in Zanzibar, one of East Africa's most iconic heritage structures and a landmark of major historical and architectural significance. Originally constructed in the late nineteenth century, the building represents an important example of Swahili-Arabic architectural influence combined with colonial-era technological innovation. Its deterioration and subsequent reconstruction present an important learning opportunity regarding the competencies required for heritage conservation practice. The reconstruction of the House of Wonders is not a routine building rehabilitation project. It involves heritage-sensitive structural intervention, multidisciplinary technical coordination, historical preservation requirements, regulatory oversight, and integration of both traditional and modern conservation approaches. As such, it provides an appropriate case through which to examine the alignment between academic preparation and practical professional requirements.

While heritage conservation has received growing scholarly attention internationally, relatively limited research has examined how architectural education in Tanzania prepares graduates for practical engagement in heritage conservation projects. Existing discussions tend to focus either on conservation policy, architectural history, or project-level technical interventions, with less attention given to the interface between professional education and conservation practice. This study addresses that gap by examining how competencies required in a major heritage reconstruction project compare with those emphasized in architectural education. Using the reconstruction of the House of Wonders as an instrumental case study, the study explores practitioner experiences, identifies competency gaps, and reflects on opportunities for strengthening architectural training to better support heritage conservation practice. The study is guided by the following research question: To what extent does architectural education in Tanzania equip graduates with the competencies required for effective participation in heritage conservation projects? The objectives of the study were to:

- examine the practical competency demands of heritage conservation using the House of Wonders reconstruction project;
- assess the extent to which existing architectural education addresses these competencies; and
- identify opportunities for strengthening curriculum responsiveness to heritage conservation practice.

## HERITAGE CONTENT IN TANZANIAN ARCHITECTURAL CURRICULA: CONTEXTUAL OVERVIEW

Before examining the reconstruction of the House of Wonders, it is useful to situate the study within the broader context of architectural education in Tanzania. Architecture programmes generally follow a four- or five-year professional structure combining design studios, technical courses, history and theory, and professional practice modules. While these curricula include elements relevant to heritage conservation, heritage-specific competencies are often dispersed across different courses rather than organised as a coherent conservation training pathway. Table 1 provides an indicative overview of how heritage-related learning is incorporated into three architecture programmes in Tanzania (U1, U2, and U3). The table is derived from a documentary review and an indicative curriculum mapping of explicit heritage courses across undergraduate architecture program structures and course descriptions from the selected institutions. The programmes are anonymized because the purpose of this section is not to comparatively rank institutions, but to identify broader structural tendencies in heritage-related architectural training. The purpose of this overview is not to present a full curriculum analysis, but to illustrate the educational baseline against which the competency demands observed in the House of Wonders reconstruction can be interpreted. This pattern suggests that heritage education in Tanzanian architecture programmes is generally limited to isolated or elective exposure rather than a sequential competency pathway.

**Table 1. Indicative positioning of heritage-related competencies in Tanzanian architecture curricula**

| Programme | Heritage-related course | Status | Competency focus | Structural limitation |
|---|---|---|---|---|
| U1 | Architectural Conservation | Elective (Y4) | Principles, documentation, heritage values | Single exposure; foundational |
| U2 | Architectural Conservation | Core (Y3) | Theory, policy, heritage management | Isolated module |
| U3 | Conservation Technology | Elective | Theory, historic materials, rehabilitation | Single exposure; introductory |

Across the programmes examined, heritage learning typically appears either as an isolated module or as an elective offered in later stages of training. In many cases, heritage concepts are also embedded indirectly in history, urban design, or construction technology courses, where they primarily contribute to cultural literacy rather than conservation practice. As a result, competencies central to heritage management, such as regulatory compliance, interdisciplinary coordination, material compatibility assessment, and community engagement, are not always developed systematically within architectural education. Several of these competency areas also emerged repeatedly in the House of Wonders interviews as critical practical demands within conservation practice. This overview should therefore be understood as contextual rather than exhaustive. It does not claim to represent a comprehensive national curriculum audit, but instead highlights recurring tendencies relevant to interpreting the competency demands emerging from the House of Wonders reconstruction project. The reconstruction of the House of Wonders, therefore, provides an instructive case through which to examine how these competency gaps become visible in real conservation practice, particularly within a complex World Heritage context.

## DESCRIPTION OF THE CASE STUDY

The House of Wonders (Beit al-Ajaib), located in Stone Town, Zanzibar, is one of the most prominent architectural landmarks on the Swahili Coast and is part of the UNESCO World Heritage Site of Stone Town. Constructed in the early 1880s under Sultan Barghash bin Said, the building embodies a hybrid architectural language combining Swahili, Islamic, European, and Indian influences. Built using coral rag masonry, mangrove poles, cast iron, and steel elements, it represents both technological innovation and cultural symbolism within Zanzibar's urban history (Folkers, 2013; Longair et al., 2023). The case study is positioned after the literature and curriculum overview sections to situate the reconstruction within the broader educational and institutional context that informs the study. Figure 1 illustrates the building prior to the recent structural failures and restoration efforts.



**Figure 1. The House of Wonders (Beit al-Ajaib), Stone Town, Zanzibar, 2010. Photograph by Moongateclimber, Wikimedia Commons, CC BY-SA 4.0**

Despite its symbolic importance, the structure has long faced structural vulnerabilities linked to material decay, environmental exposure, and successive alterations. Partial collapses occurred in 2012 and again in December 2020, exposing weaknesses in maintenance, regulatory oversight, and conservation capacity (Longair et al., 2023; UNESCO World Heritage Centre, 2021). Subsequent emergency stabilisation and rehabilitation efforts involved international technical reviews and diagnostic investigations, highlighting the complexity of conserving large-scale coral rag structures within a living historic city. The extent of the structural damage following the 2020 collapse is shown in Figure 2.

The reconstruction of the House of Wonders, therefore, provides a critical lens for examining the intersection of architectural education, professional competencies, and heritage governance in Tanzania. As a high-profile conservation project operating under UNESCO scrutiny and national regulatory frameworks, it reveals the technical, institutional, and educational demands placed on architects working in historic environments. The case was selected because it represents one of the most technically and institutionally complex conservation projects recently undertaken in Tanzania, involving multidisciplinary collaboration, international oversight, emergency stabilization, and the reconstruction of a nationally symbolic heritage structure within a living World Heritage city. The case thus serves as an instrumental example for analyzing how architectural training aligns with, or fails to align with, the practical realities of heritage management in Tanzania. While the House of Wonders represents an exceptional and highly visible heritage project, the case provides valuable insight into broader competency, governance, and institutional challenges that may also affect conservation practice in other historic contexts in Tanzania. Rather than treating the House of Wonders merely as an isolated restoration project, this study approaches it as a context through which broader tensions between conservation practice, institutional capacity, and architectural education become visible.



**Figure 2. Structural damage at the House of Wonders (Beit al-Ajaib), Stone Town, Zanzibar, 2021. Photograph by Smartcam, Wikimedia Commons, CC BY-SA 4.0**

## METHODOLOGY

To examine the disconnect between architectural education and the practical demands of heritage conservation in Tanzania, this study adopted a qualitative case study approach centred on the reconstruction of the House of Wonders in Stone Town, Zanzibar. The site was selected because of its historical prominence, symbolic value within a UNESCO World Heritage Site, and the complex technical and institutional challenges associated with its recent reconstruction. Qualitative case study methodology is well-suited to investigating contemporary phenomena within real-life contexts (Creswell, 2007). By focusing on a bounded and context-specific project, the study generated in-depth insights into the competencies, constraints, and professional dynamics shaping heritage practice (Patnaik & Pandey, 2019). The House of Wonders served as an instrumental case through which broader issues of architectural training and conservation governance in Tanzania could be examined. The study adopted an interpretive qualitative approach to understand how participants experienced and interpreted the professional, institutional, and technical realities of heritage conservation practice. To ensure qualitative rigor, the research design was guided by the trustworthiness criteria established by Lincoln and Guba (1985) and further operationalized by Stahl and King (2020).

Purposive sampling was employed to select participants directly involved in the reconstruction process. This strategy identifies information-rich cases aligned with specific research objectives (Patton, 2002). Six professionals were selected: an architect, a structural engineer, a safety engineer, a quantity surveyor, a historian, and an artisan. Although the study focuses on architectural competencies, participants from other professions were included because the reconstruction process was inherently interdisciplinary, and their perspectives were essential for understanding the broader technical, managerial, and collaborative demands placed on architects within conservation practice. Each participant possessed direct experience with the project's technical, managerial, or material dimensions. The sample size was considered appropriate for the exploratory and interpretive nature of

the study, which prioritised depth of professional experience rather than statistical representation. Interviews continued until sufficient thematic consistency was observed across the principal areas of inquiry. The study does not seek statistical generalization, but rather analytical insight into competency and institutional issues emerging within a complex heritage reconstruction context.

Semi-structured interviews were conducted using open-ended questions addressing: the role of architects in heritage reconstruction; project challenges; regulatory and institutional considerations; the use of advanced technologies; knowledge transfer; and perceived training gaps within architectural education. The interview guide was developed from the study objectives and literature review themes, ensuring consistency across interviews while allowing flexibility for participants to elaborate on context-specific experiences. Interviews lasted between 32 minutes and 1 hour 43 minutes. Five interviews were conducted in Swahili and one in English. All interviews were audio-recorded with consent, transcribed verbatim, and, where necessary, translated into English. Translations were cross-checked against original audio recordings to preserve contextual meaning and terminological accuracy. Ethical approval was obtained from the Ardhi University Research Ethics Committee. All participants provided informed consent prior to participation. To protect anonymity, respondents are identified using coded designations (R1–R6).

Thematic analysis was employed to examine the interview data. An initial coding framework was developed deductively from the literature review and research objectives. Transcripts were imported into NVivo (QSR International) to facilitate systematic organization and coding. While predefined themes guided the initial analysis, the process remained iterative, allowing inductive subthemes to emerge from participant emphasis. This hybrid deductive-inductive approach ensured both theoretical alignment and openness to context-specific insights. To strengthen analytical rigor, the research team reviewed coded excerpts collaboratively to identify patterns, relationships, and conceptual refinements. OpenAI's ChatGPT was used only at an exploratory stage to assist with thematic organization and pattern identification; it did not generate findings or replace researcher interpretation. All coding decisions, thematic refinements, and analytical conclusions were conducted and validated by the researchers. Data triangulation was achieved by integrating interview findings with documentary evidence, including conservation reports, policy frameworks, books, and peer-reviewed literature. Credibility, dependability, and confirmability were strengthened through triangulation, collaborative cross-checking, and maintenance of a transparent analytical audit trail. Ultimately, four core themes and associated subthemes were refined to address the study's central research question. This methodological approach ensured that the analysis remained grounded in empirical data while maintaining alignment with established qualitative research standards (Denzin & Lincoln, 2018).

## EMPIRICAL FINDINGS AND DISCUSSION

The findings and discussion are presented in an integrated manner to connect empirical evidence from the reconstruction of the House of Wonders with broader debates in heritage conservation, professional competency development, and architectural education. The analysis is organised around four interrelated themes: (1) architectural roles and competencies in heritage conservation; (2) structural challenges shaping heritage management; (3)

knowledge transfer and capacity development; and (4) the role of advanced diagnostic and digital technologies in conservation practice.

**Architectural Roles and Competencies in Heritage Conservation**

The findings show that architects involved in the reconstruction of the House of Wonders assumed responsibilities beyond conventional design practice. Five of the six respondents emphasized roles involving documentation, regulatory compliance, material authenticity, interdisciplinary coordination, project leadership, and community engagement. These responsibilities align with conservation discourse that positions architects as stewards of cultural significance rather than solely as designers (Feilden & Jokilehto, 1998; Orbaşli, 2008). They also suggest that heritage conservation requires architects to operate as coordinators, negotiators, and mediators within complex institutional and social environments. The expanded professional competency domains identified during the reconstruction process are summarised in Table 2.

**Table 2. Expanded professional competency domains in architectural heritage practice**

| Sub-theme | Key insight | Supporting quote |
|---|---|---|
| Client Engagement and Change Management | Architects must mediate between client demands and heritage values. | "You listen to the client… but ensure changes don't disturb the heritage value." (R1) |
| Documentation and Identification | Documentation is essential for prioritizing what to preserve. | "Identification is done to prioritize what should be preserved… and document them thoroughly." (R1) |
| Policy and Regulatory Compliance | Lack of legal knowledge leads to project rejection or delay. | "Most architects overlook the laws… and that's why many drawings are rejected." (R2) |
| Leadership, Collaboration, and Project Execution | Architects act as project leaders, ensuring compliance and team coordination. | "The architect stands as a project manager… ensuring the project is done according to conservation guidelines." (R6) |
| Technical Integration, Materials, and Authenticity Management | Materials should match or closely resemble the original ones used. | "You do 'replacement by like' the same or nearly identical material." (R2) |
| Multidisciplinary Coordination | Architects must coordinate input from specialists across disciplines. | "The architect is the leader of the management team and is supposed to interact actually with every professional... collaborating with surveyors, engineers, and service engineers." (R1) |
| Community Engagement | Architects must engage with residents whose lives are impacted by conservation work. | "Sometimes the buildings are attached to neighbours… you must talk to residents." (R5) |

**Client Engagement and Change Management**

Respondents emphasized the architect's mediating role between client expectations and conservation principles. As R1 stated: "You listen to the client… but ensure changes don't disturb the heritage value." This indicates that conservation practice involves continuous negotiation between economic pressures, functional adaptation, and heritage values. In Stone Town, such negotiation requires ethical judgment and the ability to safeguard cultural significance while responding to practical demands.

**Documentation and Identification**

In the absence of original drawings for the House of Wonders, documentation emerged as a foundational competence. R1 noted: "Identification is done to prioritize what should be preserved… and document them thoroughly." Documentation aligns with long-established conservation principles requiring rigorous recording before intervention (ICOMOS, 1964). In contexts characterized by incomplete archives and successive alterations, architects must assume investigative roles, directing surveys, historical analysis, and condition assessments prior to design decisions. These observations highlight how conservation practice requires architects to combine design thinking with investigative and research-oriented competencies that are not always systematically emphasized within architectural training.

**Policy and Regulatory Compliance**

Regulatory literacy was repeatedly identified as a weakness. R2 observed: "Most architects overlook the laws… and that's why many drawings are rejected." Proposal rejections by conservation authorities indicate gaps in legal understanding and procedural awareness. International frameworks, including the World Heritage Convention and its Operational Guidelines (UNESCO, 1972; UNESCO World Heritage Centre, 2024), underscore the centrality of compliance within conservation governance. These observations indicate that heritage practice requires regulatory literacy, procedural awareness, and institutional coordination extending beyond conventional studio-based design preparation.

**Leadership, Project, and Resource Management**

Participants described architects as coordinators and project leaders within multidisciplinary teams. R6 explained: "The architect stands as a project manager… ensuring the project is done according to conservation guidelines." Heritage reconstruction projects operate within financial, technical, and institutional constraints requiring sequencing, budgeting, and stakeholder coordination. Contemporary conservation scholarship similarly recognizes the architect's expanded leadership role in managing complex processes (Grujoska-Kuneska, 2024). These challenges highlight the growing importance of financial negotiation, phased implementation, budgeting, and resource prioritisation within both conservation practice and architectural education.

**Technical Integration, Materials, and Authenticity**

Material compatibility and authenticity were consistently emphasized. R2 stated: "You do 'replacement by like' the same or nearly identical material." This principle resonates with the Nara Document on Authenticity (ICOMOS, 1994), which stresses respect for original materials and cultural context. In Zanzibar, knowledge of coral rag masonry, lime mortar, and traditional timber systems is essential to prevent structural incompatibility and loss of heritage value. Participants also highlighted the challenge of integrating modern services within historic fabric, requiring technical judgment that balances adaptation and preservation.

**Multidisciplinary Coordination**

The reconstruction process required sustained collaboration among engineers, historians, archeologists, artisans, and surveyors. R1 noted: "The architect is the leader of the management team… collaborating with surveyors, engineers, and service engineers." Conservation charters have long recognized that safeguarding heritage demands interdisciplinary cooperation (ICOMOS, 1964). The findings reinforce that effective conservation practice depends not only on technical expertise but also on the architect's ability to synthesize diverse

forms of specialist knowledge while maintaining conservation coherence.

**Community Engagement**

Participants also emphasised the social dimension of conservation. R5 explained: "Sometimes the buildings are attached to neighbours you must talk to residents." In dense historic urban settings such as Stone Town, conservation interventions directly affect surrounding communities. This aligns with people-centered approaches advocated in the Historic Urban Landscape framework (UNESCO, 2011), which recognize local residents as key stakeholders in heritage governance. The findings suggest that community engagement should be understood as a core conservation competency rather than a peripheral social consideration.

**Thematic Synthesis**

Collectively, these findings reveal that heritage reconstruction requires an expanded professional profile integrating regulatory literacy, documentation expertise, material knowledge, interdisciplinary leadership, and community engagement. While international conservation frameworks have long articulated these competencies, their systematic and practice-oriented integration into architectural education appears to remain limited. The reconstruction of the House of Wonders thus exposes a structural misalignment between doctrinal expectations and professional preparation.

## CHALLENGES AND SOLUTIONS IN HERITAGE MANAGEMENT

Beyond individual competencies, the reconstruction of the House of Wonders revealed systemic constraints that shape heritage outcomes in Zanzibar. Participants identified financial pressures, regulatory inconsistencies, development-driven transformation, material scarcity, and shortages of trained specialists as interconnected structural challenges, with most respondents highlighting financial constraints and shortages of trained conservation specialists as the most critical barriers. These findings suggest that heritage conservation operates within broader institutional, economic, and governance conditions that extend beyond technical design considerations alone. Such dynamics reflect wider structural challenges documented in sub-Saharan conservation contexts (Ndoro & Pwiti, 2005; UNESCO, 2016). The principal structural challenges affecting heritage conservation practice identified by respondents are summarised in Table 3.

**Table 3. Structural constraints and capacity gaps in heritage management**

| Sub-theme | Key insight | Supporting quote |
|---|---|---|
| Financial and Client-Related Challenges | Limited budgets and unrealistic client expectations hinder quality. | "Conservation is very expensive… if the architect is not careful, it can lead to losses." (R5) |
| Modernization, Investment, and Tourism | Tourism leads to over-commercialisation and threatens authenticity. | "Hotels are replacing homes… this impacts authenticity." (R4) |
| Legal and Regulatory Gaps | Regulatory frameworks exist, but enforcement is inconsistent. | "They fail to follow the policies, even though they are given by the Mji Mkongwe authority." (R5) |
| Building Materials Challenges | Shortages of traditional materials affect restoration work. | "Some materials used in the 1800s are no longer available." (R3) |
| Training and Expertise Gaps | Lack of formal conservation education limits capacity. | "We need to create conservation architecture as a field." (R1) |

**Financial and Client-Related Constraints**

Heritage conservation was consistently described as resource-intensive. R5 explained: "Conservation is very expensive… if the architect is not careful, it can lead to losses." Detailed investigations, specialized materials, and multidisciplinary coordination significantly increase project costs. At the same time, clients often underestimate the financial implications of conservation, creating tension between cost control and heritage integrity. Several respondents emphasized that architects often play a mediating role between regulatory requirements and client expectations. This dynamic reflects a broader governance challenge, where heritage sites are expected to generate economic value while operating within constrained funding environments (UNESCO, 2016). These challenges highlight the growing importance of competencies in financial negotiation, phased implementation, budgeting, and resource prioritisation within both conservation practice and architectural education.

**Modernisation, Tourism, and Development Pressures**

Several participants highlighted tensions between conservation objectives and tourism-driven urban transformation in Stone Town. R4 observed: "Hotels are replacing homes… this impacts authenticity." Similarly, R1 warned that economic pressures associated with tourism risk altering the cultural landscape of historic neighborhoods. These concerns resonate with international debates regarding the commodification of World Heritage cities, where market forces may undermine social continuity and authenticity (UNESCO et al., 2016). These observations suggest that architects working within historic urban environments must balance economic viability, adaptive reuse, tourism pressures, and long-term cultural sustainability.

**Legal and Regulatory Gaps**

Although conservation legislation exists, respondents reported inconsistent enforcement and limited compliance. R5 noted: "They fail to follow the policies, even though they are given by the Mji Mkongwe authority." This suggests that regulatory frameworks alone are insufficient without professional literacy and institutional coordination. International conservation governance emphasizes that effective heritage protection depends on procedural adherence and institutional capacity (UNESCO, 1972; UNESCO World Heritage Centre, 2024). These observations suggest that legal literacy and procedural awareness remain underdeveloped areas within conservation-oriented professional preparation, contributing to delays, approval challenges, and inconsistent implementation practices.

**Material Scarcity and Technical Constraints**

Participants frequently raised the diminishing availability of traditional materials as a key challenge in conservation practice. R3 explained: "Some materials used in the 1800s are no longer available. You must identify alternatives carefully." In coral rag structures such as those in Stone Town, inappropriate substitutions risk structural incompatibility and the erosion of authenticity. Conservation doctrine emphasizes respect for material integrity within cultural context (ICOMOS, 1994). Participants highlighted the technical judgment required to evaluate alternative materials while preserving structural and aesthetic coherence. The findings further suggest that conservation practice increasingly requires architects to understand material compatibility, sourcing limitations, and the long-term implications of technical substitution within historic environments.

**Training and Expertise Gaps**

Perhaps the most critical structural constraint identified was the limited

availability of formally trained conservation architects. R1 stated: "We need to create conservation architecture as a field." R2 similarly emphasized that few professionals possess specialized heritage training, resulting in reliance on foreign consultants for complex interventions. This pattern reflects wider capacity gaps documented across African heritage systems (Ndoro & Pwiti, 2005; UNESCO, 2016). While external expertise may provide short-term technical support, it limits sustainable knowledge transfer and local ownership. Some participants proposed establishing postgraduate specializations, strengthening collaboration with heritage authorities, and institutionalizing structured training pathways. These proposals align with international capacity-building recommendations for sustainable conservation governance (UNESCO, 2011). The findings therefore reinforce broader concerns regarding the limited institutionalisation of conservation-oriented architectural training within the Tanzanian context.

**Thematic Synthesis**

Collectively, these findings reveal that heritage conservation in Zanzibar is shaped by intertwined financial, institutional, material, and developmental pressures. While international frameworks provide normative guidance, effective implementation depends on local capacity, regulatory literacy, and sustained investment in professional training. The reconstruction of the House of Wonders thus exposes structural vulnerabilities within the broader heritage management system, reinforcing the urgency of embedding financial literacy, regulatory competence, and conservation specialization within architectural education. Rather than representing isolated project-specific problems, these challenges appear interconnected with broader questions of institutional capacity, professional preparation, and governance within heritage conservation practice.

## KNOWLEDGE TRANSFER IN HERITAGE CONSERVATION

The interviews revealed broad recognition of knowledge transfer as essential to sustainable heritage conservation. Five of the six respondents emphasized mentorship, on-site learning, and collaboration with local artisans, while also noting the absence of structured institutional mechanisms to support such transfer. The findings suggest that conservation capacity depends not only on technical expertise but also on systems for transmitting expertise across generations of practitioners. The key dimensions of knowledge transfer identified during the interviews are summarised in Table 4.

**Table 4. Thematic dimensions of knowledge transfer in heritage practice**

| Sub-theme | Key insight | Supporting quote |
|---|---|---|
| Awareness of Knowledge Transfer Responsibility | Architects are aware of the need to mentor but lack formal systems. | "It should be mandatory that any conservation architect mentors… it's part of their responsibility." (R1) |
| Community Involvement and Collaboration | Knowledge exchange with local artisans enriches conservation. | "Most of those who make these Stone Town paintings involve the residents here in Stone Town to help them." (R2) |
| Institutional and Systemic Factors Hindering Knowledge Transfer | Lack of time and resources hampers structured knowledge transfer. | "And what conducive environment are they preparing for an architect to disseminate that knowledge to the younger generations or other people?" (R1) |
| Knowledge Transfer During Projects | On-site learning is the most effective form of training. | "When trainees come to the field, they learn under guidance… competence is built from exposure." (R6) |

**Mentorship and Professional Responsibility**

Several participants framed mentorship as an ethical obligation of experienced conservation professionals. R1 stated: "It should be mandatory that any conservation architect mentors at least one to three young architects… it's part of their responsibility." This perspective aligns with international conservation principles that emphasize intergenerational transmission of expertise as essential to safeguarding cultural heritage (UNESCO, 2011). However, in the Tanzanian context, mentorship practices remain informal and dependent on individual initiative rather than contractual requirements or institutionalized programs. The findings indicate that conservation knowledge transfer currently relies heavily on personal commitment rather than structured professional systems. The absence of formal apprenticeship systems limits continuity and long-term skills retention.

**Community-Based Knowledge Exchange**

Several participants emphasized the importance of engaging local artisans and residents as active contributors to conservation processes. R2 explained: "Most of those who make these Stone Town paintings involve the residents here… foreigners' drawings are rejected until experienced local actors provide guidance." This observation highlights the role of tacit, community-embedded knowledge in sustaining architectural authenticity. People-centered conservation frameworks emphasize that heritage management should integrate lived experience and indigenous practices alongside professional expertise (Ndoro & Wijesuriya, 2015). The findings therefore suggest that local communities and artisans should not be viewed merely as labour providers, but as important custodians of practical conservation knowledge. In culturally layered urban environments such as Stone Town, conservation outcomes depend not only on technical skill but also on collaborative engagement with local knowledge systems.

**Institutional and Structural Barriers**

Despite widespread recognition of its importance, respondents identified structural constraints limiting systematic knowledge transfer. Time pressures, budgetary limitations, and administrative challenges often reduce opportunities for structured training during active projects. R1 observed: "What conducive environment are they preparing for an architect to disseminate that knowledge to the younger generations?"

Such constraints reflect broader institutional weaknesses documented in heritage governance systems, where limited coordination between universities, heritage authorities, and professional practice restricts sustained capacity development (EU Heritage, 2017; GCI, 2020). As a result, conservation expertise remains unevenly distributed and difficult to institutionalize. The findings indicate that without supportive institutional frameworks, knowledge transfer remains vulnerable to discontinuity and loss.

**Learning Through Practice**

Participants consistently identified field exposure as the most effective mechanism for building conservation competence. R6 explained: "When trainees come to the field, they learn under guidance… competence is built from exposure." Practice-based learning enables the transmission of tacit knowledge that cannot be fully replicated through classroom instruction. However, without formal integration into curricular structures, such experiential learning remains episodic and difficult to scale within architectural education programs. The reconstruction of the House of Wonders illustrates both the potential and the fragility of project-based capacity-building. The findings therefore reinforce the importance of integrating field-based and experiential learning

approaches within heritage-oriented architectural education.

**Thematic Synthesis**

Overall, the findings indicate that while practitioners are aware of their knowledge transfer responsibilities, institutional frameworks to support structured and sustained capacity-building remain limited. International conservation discourse emphasizes that long-term heritage resilience depends on embedding mentorship, university-authority partnerships, and project-based training within formal educational pathways (UNESCO, 2011; Ndoro & Wijesuriya, 2015). In the Tanzanian context, bridging architectural education and heritage practice, therefore, requires transforming informal exposure into institutionalized systems of training and professional development. Without such reform, conservation expertise risks remaining dependent on ad hoc learning and external support, undermining sustainable local capacity. The reconstruction of the House of Wonders thus demonstrates that conservation competence is sustained not only through technical intervention, but also through the continuity of institutional and intergenerational learning processes.

## ADVANCED DIAGNOSTIC AND DIGITAL TECHNOLOGIES IN ARCHITECTURAL CONSERVATION

The reconstruction of the House of Wonders highlights the growing centrality of diagnostic and digital technologies in conservation practice. In the absence of reliable archival documentation and structural records, participants emphasized that scanning technologies, material testing, and scientific diagnostics were essential for assessment, documentation, and informed intervention. These tools are increasingly foundational rather than supplementary to conservation practice. The technological tools and competencies applied during the reconstruction process are summarized in Table 5.

**Table 5: Technological and Diagnostic Competencies Applied in the Conservation of the House of Wonders**

| Sub-theme | Key insight | Supporting quote |
|---|---|---|
| Key Technologies for Architectural Conservation | 3D scanning, sonic testing, and material analysis were key in assessing the House of Wonders. | "These buildings have been subjected to X-rays and sonic tests." (R2) |
| Importance of Technology in Conservation | Technology is essential for diagnosing and documenting conditions in heritage buildings. | "This technology [scanning] enables us to get real-time, precise and accurate elevations and sections… even the smallest and most overlooked features will be found." (R1) |
| Need for Training and Integration of Technologies | Local professionals often lack training in advanced technologies, resulting in a reliance on external experts. | "We need to prepare architects in this sense of professional practice… and introduce technologies through practical exposure." (R1) |

**Diagnostic and Documentation Technologies**

Respondents described using X-ray imaging, sonic testing, and 3D laser scanning to evaluate structural integrity and material deterioration. R2 noted: "These buildings have been subjected to X-rays and sonic tests." Similarly, R1 explained: "This technology [scanning] enables us to get real-time, precise and accurate elevations and sections… even the smallest and most overlooked features will be found." These technologies enable minimally invasive investigation of fragile coral rag structures while generating precise digital documentation. International conservation standards emphasize documentation as a prerequisite for intervention (ICOMOS,

1964; UNESCO World Heritage Centre, 2024), and recent studies identify digital modeling and scanning as transformative tools in heritage diagnostics (Giuliani et al., 2024; Vacca et al., 2012). The findings demonstrate that advanced documentation technologies are no longer supplementary but foundational to evidence-based conservation decision-making.

**Material Testing and Scientific Evaluation**

Material analysis also emerged as a critical component of the reconstruction process. R5 described laboratory testing of lime-based mixtures to achieve appropriate structural strength, while R2 noted that multiple test iterations were required before acceptable results were obtained. Such practices reflect the growing integration of scientific methods into conservation decision-making, ensuring compatibility between traditional materials and contemporary stabilisation strategies. International studies similarly highlight the increasing role of digital modeling and scientific diagnostics in heritage management, including technologies such as Historic Building Information Modeling (HBIM) and 3D documentation (Giuliani et al., 2024). These tools enhance precision, facilitate monitoring, and support evidence-based conservation planning. These observations further demonstrate the increasing integration of scientific evaluation within conservation strategies, particularly when balancing traditional materials with contemporary stabilization requirements. Conservation doctrine underscores that material substitution must be carefully evaluated to preserve authenticity and structural coherence (ICOMOS, 1994). The findings suggest that contemporary conservation practice increasingly relies on integrating traditional craftsmanship, laboratory analysis, and digital diagnostics within a single decision-making framework.

**Capacity and Training Gaps**

Despite the acknowledged value of advanced technologies, participants expressed concern regarding limited local expertise. Specialized equipment and complex diagnostics were frequently undertaken by external consultants. R1 emphasized: “We need to prepare architects in this sense of professional practice… and introduce technologies through practical exposure.”

This reliance on foreign expertise reflects broader capacity constraints documented in developing heritage contexts (Eppich & Almagro Vidal, 2013). While advanced technologies enhance conservation quality, insufficient local training restricts knowledge retention and long-term sustainability. The findings, therefore, highlight a dual challenge: integrating digital and scientific tools into conservation practice while simultaneously strengthening domestic technical capacity. The findings further suggest that technological dependency may undermine long-term conservation sustainability if local professional capacity is not strengthened concurrently.

**Thematic Synthesis**

The reconstruction of the House of Wonders demonstrates that advanced diagnostic technologies and scientific material testing are integral components of contemporary heritage conservation. Accurate documentation, structural analysis, and digital modeling underpin responsible intervention in complex historic structures. However, the limited integration of conservation-specific technologies within Tanzanian architectural curricula constrains local expertise and reinforces dependence on external specialists. Bridging this gap requires embedding digital documentation, material diagnostics, and interdisciplinary technical literacy within formal architectural education. Without such reforms, the adoption of advanced conservation technologies will remain externally driven, constraining the

development of sustainable local technical capacity. The findings therefore reinforce the importance of aligning architectural education with the technological transformation currently reshaping international conservation practice.

## CONCLUSION AND RECOMMENDATIONS

The reconstruction of Zanzibar's House of Wonders offers important insight into the gap between architectural education and the practical demands of heritage management in Tanzania. Effective conservation requires architects to possess competencies extending beyond conventional design skills, including historical research, documentation, material conservation, regulatory compliance, project leadership, interdisciplinary coordination, community engagement, and the application of advanced technologies. Current architectural curricula in Tanzania provide limited, fragmented exposure to these specialized skills. As a result, architects may enter professional practice insufficiently prepared to conserve historic environments such as Stone Town. The findings suggest that limitations in heritage-oriented professional preparation may contribute to project delays, regulatory non-compliance, material incompatibility, and difficulties in maintaining authenticity during conservation processes. Architectural education should integrate heritage management principles across both theoretical and practical training, including conservation theory, material science, heritage law, community participation, and digital documentation technologies. Stronger collaboration among universities, professional bodies, heritage institutions, and local communities is also necessary to ground learning within conservation practice. Fostering knowledge transfer through mentorship, internships on restoration sites, and interdisciplinary collaboration is also essential for sustaining local conservation expertise and reducing long-term dependence on external specialists

Ultimately, the findings suggest that heritage conservation education should be understood not only as a technical specialization but also as a broader institutional and cultural process shaping how architects engage with historic environments and urban transformation. Sustainable conservation, therefore, depends not only on technical interventions but also on the alignment of professional education, institutional capacity, regulatory systems, and long-term knowledge-transfer mechanisms. Based on the findings of this study, several recommendations emerge. In the short term, architecture programmes and professional institutions should strengthen continuing professional development initiatives, workshops, and field-based exposure related to conservation practice. In the medium term, universities should integrate more structured heritage-oriented learning pathways within undergraduate architectural education, including interdisciplinary studio projects and collaborations with heritage authorities. In the long term, establishing specialized postgraduate programs and dedicated centers for built heritage conservation could sustain local expertise and reduce reliance on external specialists.

In the Tanzanian context, strengthening heritage conservation education will require closer collaboration between architecture schools, heritage authorities, and professional institutions. Partnerships among universities, heritage authorities, and professional associations could facilitate field-based training, mentorship, and interdisciplinary learning opportunities for architecture students. This study is not without limitations. The research is based on a single case study and a relatively small purposive sample of professionals directly involved in the reconstruction process. While the findings provide valuable context-specific insights, they are exploratory rather than statistically

generalizable. Some of the challenges identified in this study, particularly those related to conservation specialization, institutional capacity, and dependence on external expertise, also resonate with concerns documented in other African and postcolonial heritage contexts. Future research could expand the analysis through comparative studies involving multiple heritage projects, architectural schools, students, policymakers, and community stakeholders across Tanzania and East Africa.

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